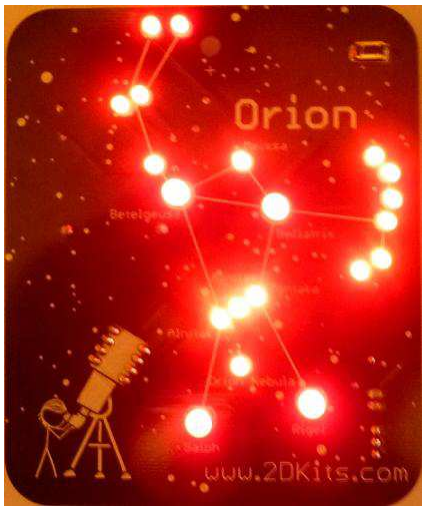
Kit 24b - Orion Blinkie G2

The heart of this blinkie is a 12F1822 PIC made by a company called Microchip. A PIC is a tiny, yet surprisingly powerful little computer.

By itself, the PIC can't do much – it needs some way to interact with the world – we are going to do this by giving it input and output:

- From us – a push button
- To us – 20 light emitting diodes (LEDs).

By building this blinkie, we hope you have a lot of fun, and learn how easy it is to assemble and solder a circuit, and gain a desire to learn more!



Use

Once built, the use of this blinkie is fairly straightforward. Don't get it wet. Don't stick it in a pocket, purse, or drawer with a bunch of car or house keys, coins, etc. where it might short out.

This blinkie has additional patterns stored in the PIC. **To change patterns, press and hold the push button** for more than one second. The bottom LED on the shield (the right 6 LEDs/Stars) will light, and then the LEDs will count up in a binary sequence, where the bottom LED is 1, the next up 2, and so on through 4, 8, and 16. Each sequence represents a different stored pattern. If the push button is released, the pattern associated with that particular binary number will then be displayed on your blinkie. It will stay on that pattern unless demo mode is on: See below.

Some Blinkie Pattern Examples:

- Pattern 1 lights one LED at a time, and can be used to check that each is lit while running
- Pattern 4 lights multiple LEDs in 3 steps: Body, then Weapon, then Shield

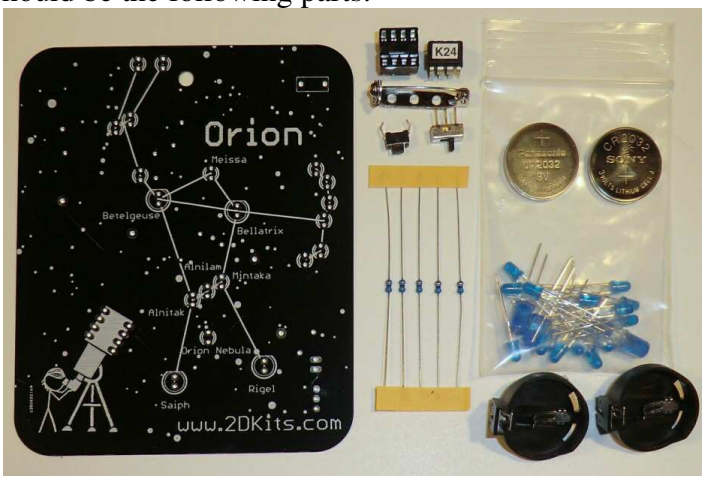
The blinkie has two display modes:

- Demo mode, where it will switch to the next stored pattern every minute. When it hits the highest pattern, it will start again with the first. If it is in demo mode, the very top most LED will be lit when the push button is held down.
- Normal mode, where will continue to display the current pattern until a new pattern is selected via the push buttons. To toggle between the modes, hold down the push button while turning on the power.

Now, on to the assembly…

First, open up the kit and review the contents.
Looking from top to bottom, and left to right there should be the following parts:

- Orion printed circuit board
- 8 pin socket for the PIC
- 8 pin MicroChip 12F1822 PIC
- Pin back to attach the blinkie to your clothing
- Push button switch
- Power switch
- Two CR2032 3V batteries – If not with the kit, ask for them.
- Five 56 ohm resistors (**green**, **blue**, **black**). Since they are all the same, "Don't worry about the colors".
- Four 5mm LEDS
- Sixteen 3mm LEDs
- Two CR2032 battery holders



The LEDs may be loose or in a separate bag. There is also a multi-colored LED pack.

Got everything to start? If not, give us a shout.

Soldering Hints

Soldering is not like gluing. The parts being soldered, such as an LED's wire (we'll call them "leads" – rhymes with "seeds" – from now on) and the circuit board's metallic pad, must get hot enough for the solder to melt and **wet** them. It creates an electrical connection and mechanical attachment. The solder has a core of rosin or flux to help "wet" the connection when soldering. The rosin is what "smokes" when you melt the solder. Try not to inhale this smoke.

Here's how to make a good solder connection between the hole in the board with it's electrical circuit pad, and the lead or pin sticking through it:

- Prepare the connection. Bend the component lead slightly after it passes through the printed circuit board. This helps hold it in place while soldering.
- The soldering iron should be up to temperature. Clean the tip by plunging it into the jar of stainless steel wool several times. Melt a little solder (a 2mm length) onto the tip so it's shiny. This is called "tinning". The solder coating helps conduct heat from the tip to the connection. If the solder doesn't stick, contact a tech for tip cleaning help.
- **Soldering a component to the circuit board:**
  1. Place the tip in contact with the component lead and the printed circuit board pad.
  2. Place the solder against the connection directly opposite the tip. It should melt within 2 seconds, and flow around the connection. If it takes longer than that, you're not getting enough heat into the connection. A clothing pin back or tie tack will take longer.
  3. Pull the solder away
  4. Keep the soldering iron in place until the solder flows freely and completely covers the connection. If the heat is removed too soon, the solder will tend to "ball up" and not stick well to the conductors. The solder connection should look shiny, covering the pad, and coming up the lead a bit.
- Let the connection cool without movement at room temperature. This usually takes only a few seconds.

- If a connection is moved before it cools, it will take on a dull, grainy look that is characteristic of a cold solder connection. A cold solder connection is fragile and conducts poorly – remelt the connection until the solder flows freely, and hold it still until it cools.
- Keep the tip of the soldering iron clean. Do the "plunge into stainless steel wool" cleaning now and then, especially when having not soldering for a while.

Assembly

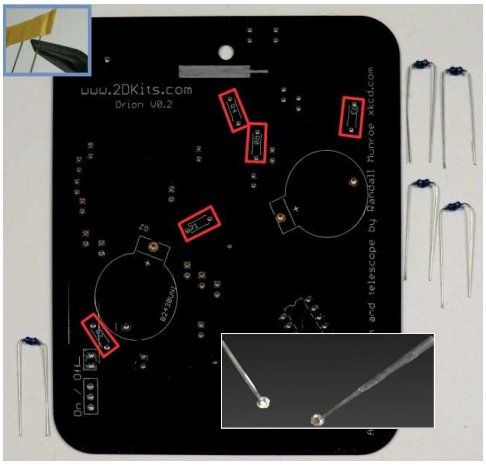
TIP: There is a **white outline** of the part (battery holder, switch, LED, resistor, etc.) showing where you push its leads through the board. You will be soldering on the OTHER side of the board. Technically the white outline is called a "silk screen". The whole black part of the board is called a "solder mask".

The **front** of the board has Orion on it, and the white outlines for the LEDs and the push button switch.

The **back** of the board has the outlines for the battery holders, PIC socket, resistors, and power switch.

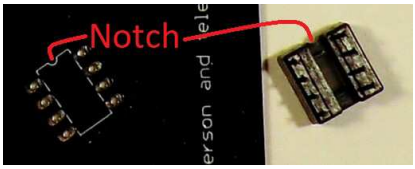
First, flip the circuit board to the back. Orient the board so the hole is at the top. You will see the silk screening for the resistors (R0, R1, R2, R3, and R4).

1. Snip the resistor leads off the tape near the tape end (See top left inset in picture to the right)
2. Bend the leads as shown. Then insert one into each location marked (R0, R1, R2, R3, and R4).
3. As each is inserted on the back side, make the 2 leads into a "V" on the front side to hold the resistor in place for soldering. See inset picture for example of "V"ing the leads
4. When they are all inserted, flip the board over to the front and solder all the leads to the circle pads they come up through.
5. Then trim the leads, and be sure to hold them so they don't fly off. Remember to trim the leads only after soldering them.
6. Flip the board over to the back for the next four steps.



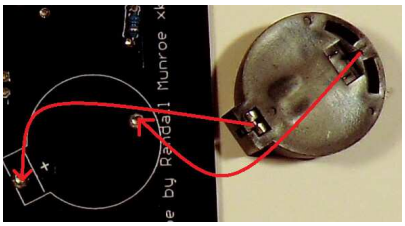
7. Open the pin on the pin back and hold it in place at one end with a clothespin. This is a larger component, so more time will be required to heat it up enough to solder. Once soldered, wait for it to cool for one minute.

8. Insert the 8 pin socket. The socket will be inserted from the back as shown. Make sure the notch on the socket matches the silk screen outline. Flip the board to the front and solder the leads. Flip the board to the back.

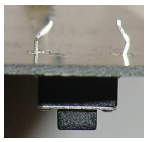


9. Insert the power switch. Flip the board over and solder the leads, making sure they are perpendicular as in the bottom right photo.
   - The 2 holes outlined above the switch are not used.

10. Insert the two battery holders. Make **sure** the squared off end of the holder goes into the hole near the squared off end on the silk screening. Flip the board over and solder the leads.



11. Insert the push button. It will snap into the holes. It is a tight fit, so some wiggling to get it to snap in properly may be necessary. Flip the board over to the back and solder the leads.

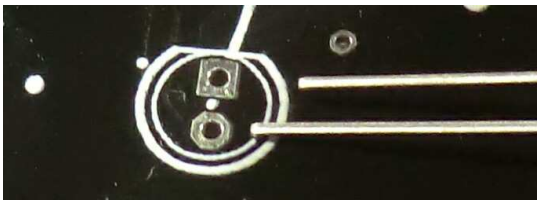


Edge-on view of the inserted push button.

If you are doing the multi-colored LEDs to approximate the star colors, see the steps on the **last page** to determine which LED to put where, and do them one at a time using the following steps.

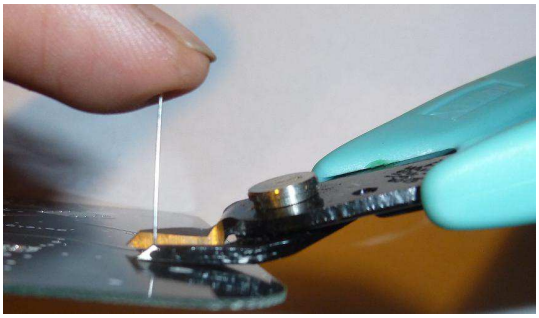
12. Insert each LED into the board from the front side.

- Insert the 16 smaller (3mm) LEDs where the smaller outlines are. **LONG lead, ROUND hole**
- On the back, make the parallel leads of each LED into a narrow V to hold them in and make soldering easier. Solder those 16 LEDs and trim their leads.
- Then repeat the above steps with the 4 larger (5mm) LEDs over the 4 larger outlines on the front. Remember **LONG lead, ROUND hole**. Flip the board over and solder the lead and trim them.



13. When trimming the leads, be sure to catch them from flying off as shown in the picture.

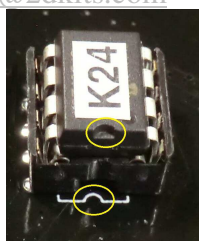
14. Although the leads are short on the socket, push button, power switch, and two battery holders, you may want to trim them flush with the board, they are a bit sharp.



15. Verify the power switch is off, then insert the batteries.

- "**+**" side up
- Angle the battery down and in against the metal tab at the square end.
- Then push the battery in and down from the side opposite the square end.

16. The PIC chip is inserted so the **notch** on the end **lines up with the silk screened notch on the circuit board.**



- If you put the SOCKET in backwards, you are OK! Just make sure the PIC chip notch lines up with the silk screened notch on the board.
- If you can't SEE the notch, you can feel it with a fingernail.

17. Turn the power on and enjoy.

Troubleshooting

If one or more of the LEDs don't flash, then you'll need to do a little troubleshooting to finish your project. The following steps should isolate most problems.

If your LEDs blinked in testing, but not after soldering, you may have a solder bridge, as shown in the picture. Power flows through the **bridge**, instead of the LED. (Turn the power switch off!!!)

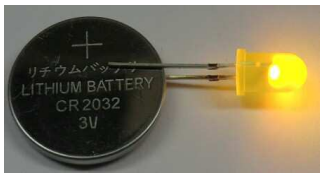
A bridge is easy to fix. You can often just remelt it and pull the tip of the soldering iron through the bridge, breaking it, then shake any captured solder off the iron. Or, remelt all the solder and tap the board on the edge to shake off the excess while it is still melted. ...Or ask for help.

- **A common soldering problem** is to have solder on the lead but NOT connecting it to the pad. Notice the pad UNDER the solder in the picture:
- Remelt the connection, being sure to press DOWN on the pad with the soldering iron tip and wait for the solder to "puddle" around the pad and pin.

- Recheck your solder connections. 80% of all problems are traced to this. Cold solder connections and broken connections will cause erratic performance or failure. Remelt any questionable solder connections until they flow and look shiny and secure.
- Check that every connection **is soldered!** We occasionally see missed pins on a socket, etc.
- Check for bits of solder, lead ends, or other foreign matter which may be lodged in the wiring.
- LEDs were reversed.
- Batteries incorrectly inserted. The "+" side of the battery should always be inserted facing up.
- Bad part – it does happen. In the thousands of kits built, we've seen only a handful of parts fail. Send us email, and we will send a replacement part.
- A part got lost/melted/damaged/destroyed while building the kit. It happens – you're not the first (or second, or fiftieth). Let us know, and we'll see what we can do.

Astronomic (multi-colored) LEDs:

The stars in the Orion constellation are not all the same class, or color. To somewhat simulate this we have put together a package of LEDs of various colors when they light up.



The blinkie kit Astronomic pack of LEDs may have many **clear** LEDs**,** so you need to find the color of each by hooking one at a time to a battery.

- Do this by placing the LONG lead of an LED on the + side of a battery, and the short lead on the other side, as shown in the picture.
- Then insert it in the Orion board – **long lead, round hole --** "V" the leads on the back, solder, and trim the leads, then test the color of the next clear LED. Repeat until all LEDs are installed.
- Then go back to step 12 if you have any colored LEDs to install, otherwise go to step 13.